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paratus employed in the examination of air for micro-organisms, by Dr. Percy Frankland; and a remarkable collection of gems, by Mr. Bryce Wright. Photographs of celestial phenomena and microscopic sections of devitrified rocks were exhibited in the lime-light-lantern, and demonstrated by Mr. Norman Lockyer, Mr. Common, and Mr. Rutley; and the United telephone company had established temporary communication with the Savoy theatre, where 'The Mikado' was being performed.

The annual meeting of the Marine biological association was held on June 8, Professor Huxley, the president, in the chair. The council's report mentioned a small increase in the number of members during the year, and the progress that has been made with the plans for the new laboratory at Plymouth, which will be commenced immediately. It is hoped that it may be in working order by the autumn of next year. Much interest is taken in it by the residents of Plymouth, one of whom, hearing that the council of the association were contemplating the omission, for pecuniary reasons, of certain desirable features in the building, has generously offered to provide the five hundred pounds necessary for the purpose.

A large amount of valuable zoölogical work has been recently carried out by the Liverpool marine biology committee, which was established some two years ago. The shallow water off the coast of North Wales and round the Isle of Man has been systematically explored with the dredge, with the following very gratifying results: whereas only 270 species of marine invertebrates were known from this neighborhood before 1853, 913 species are recorded in the report of the Liverpool committee. Of these, 235 were not previously known in the locality; 16 are new to British seas; while 7 species and 3 varieties are new to science. W.

London, June 14.

NOTES AND NEWS.

THE Lackawanna institute of history and science, recently founded at Scranton, Penn., has taken steps for the purchase and preservation of the two great glacial pot-holes found in the Lackawanna valley at Archbald. An illustration of one of these pot-holes was published in *Science* for Dec. 19, 1884. The second one has not yet been cleared out, but will be cleared by the Lackawanna society. These holes are described by Professor Branner in his recent paper upon the glaciation of the Wyoming and Lackawanna valley.

— The destructive effects of poisoning by phosphorus are narrated in a paper read at a recent meeting of the Ohio state medical society by a physician whose practice has been large in one of the most extensive match-factories of that state. He finds that the head of each match contains about a seventieth of a grain of phosphorus, and that the injurious results of the process are most marked among those who work in the dipping and packing rooms. The affection is a disease of the bones of the jaw known as necrosis. In some it appears within two years after they enter the factory; in others its appearance is more delayed. Operatives with unsound teeth are the most susceptible. He recommends that only persons possessing sound teeth be employed in these two rooms; that thorough ventilation be provided in all parts of the factories; that the operatives be not permitted to eat their meals within the factory or with soiled hands; and, finally, that mouth-washes of the alkaline carbonates be freely used.

— O. P. Jenkins was elected, June 23, professor of biology, and curator of the museum at DePauw university, Greencastle, Ind.

— The *Sanitarian* records an instance of flies acting as sanitary inspectors. In one of the rooms of a residence in an eastern city, offensive odors were detected, but their exact source could not be located. The carpets were raised, and a carpenter engaged to take up the entire floor. At this moment a friend who chanced to come in, suggested that an appeal be made to the instinct of the fly. Two blue-bottles were brought from a neighboring stable, and the doors and windows of the room closed. The flies soon settled upon one of the cracks in the floor, and, when the boards were raised at this point, a decomposed rat was found.

— The Japanese disease beri-beri, or kakké, is now regarded as a contagious disease, having for its cause a microbe. The infection enters through the intestinal canal, and locates itself at this part of the economy.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

The flight of the flying-fish.

THE question, among naturalists with whom I have been associated, as to whether or not the flying-fish flaps its wings during its flight, was at first a great surprise to me. My years of sea-service, without hearing a single doubt upon this point, had been exclusively among seafaring men, who are generally positive: naturalists seldom are. Nevertheless, association with the former teaches one that their 'opinion' on a subject is, as a rule, a confirmed belief.

In the region of the Cape de Verde Islands, where a very large species of flying-fish is abundant, it is easy to observe the beating of the creature's wings;

but on our own coast, where the fish — and wings — are small, the vibration is so rapid, that, at the usual distance, one cannot well distinguish the motion.

Viewing the question from an engineering standpoint, the problem resolves itself into a simple calculation, the only element of error being in the correctness of observation: for the flight of the fish can only be observed from the deck of a vessel, and the direction of the creature's flight must, at best, be an approximation. The mean of a large number of observations, however, should give a result very close to the truth. Though the flying-fish usually starts directly to windward, it seldom continues in that direction; and, because of this erratic flight, the observation is still more difficult.

The opinion of the naturalists was that the creature projected itself out of the water with great velocity, in a direction opposite to that from which the wind was blowing, and, by placing its wings (pectoral and ventral fins) at an advantageous angle, so pressed them against the atmosphere as to lift its body, while its inertia carried it forward over the surface of the sea like the projectile from a gun. In this event two forces would be acting upon the fish: that of gravity, to pull it to the water; and the resistance of the atmosphere, to retard its forward velocity. Its motion of translation would essentially be uniformly retarded. As its velocity diminished, it would be obliged to alter the angle of its wings, in order to preserve its horizontal line of flight; and this movement would present a greater projected area of wing to the direction of its flight, and therefore its motion would be retarded in a greater ratio than that of a fired projectile having a constant plane of resistance. Artillerists, both on land and sea, are satisfied that they can distinguish the retardation of a cannon-shot: indeed, I doubt if one can be found who would question it; and yet seafaring men are positive the flight of flying-fish is uniform.

A school of flying-fish will keep together in the air quite as well as a flock of ducks. As nearly as one can judge from looking at them, they move at the same velocity. Now, if they continue to move at equal velocity, and do not flap their wings, it follows that they must have projected themselves from the water with equal velocity, and that there must be a constant ratio between the area of their wings and the weight of their bodies. That this is not true is evident, from the following measurements made early in April of this year, from three live specimens of Exocoetus robustus[1] as soon as they were taken from the water.

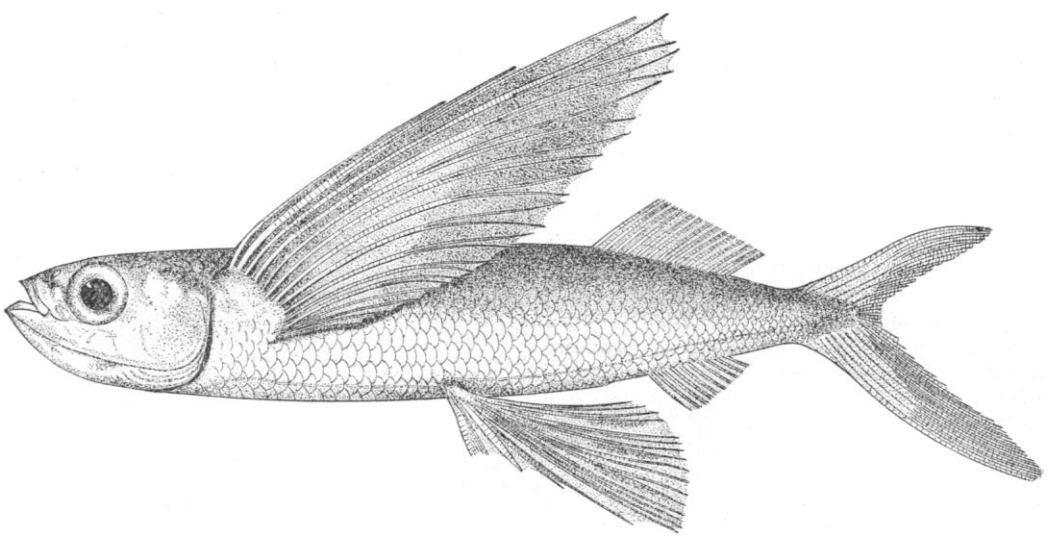

FIG. 1. — FLYING-FISH (EXOCOETUS ROBUSTUS).

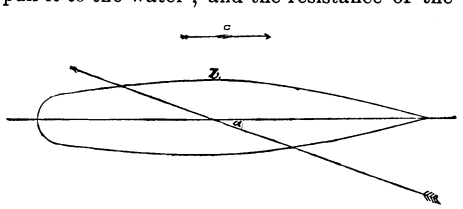

FIG. 2.

Number of the specimen.	Length of pectorals in inches.	Length of ventrals in inches.	Area of each pair of pectorals in square inches.	Area of each pair of ventrals in square inches.	Total area of wing-fins in square inches.	Weight of the fish in ounces, avoirdupois.	Ratio of area to weight.
1	5 1-4	2 1-2	21.328	6.797	28.125	5	5.625
2	3 5-8	2 5-16	8.700	5.261	13.961	2	6.9805
3	3	1 7-8	7.314	3.896	11.210	1.5	7.473
Mean	3.958	2.1458	12.447	5.318	17.765	2.833	

[1] Specimen identified by Dr. Tarlton H. Bean.

The writer was fortunate enough to observe a flying-fish (on the 9th of April, 1886) moving in a direction apparently parallel to that of the ship, and with equal velocity. By means of a Casella anemometer the velocity of the wind across the ship's deck was found to be 13.6 feet per second, and its direction was 20 degrees from ahead.

Referring to fig. 2, *b* represents the ship; *c*, the fish; and *a*, the angle of the wind. The true velocity of the fish through the air was then $13.6 \times \cos a = 12.78$ feet per second.

Let us take, for example, a specimen whose wings and weights would be a mean between the three specimens recorded.

Let A represent the area of its wings in square feet $= \frac{17.765}{144} = 0.1234$; V, its velocity in feet per second $= 12.78$; A′, the projected area of the wings; W, the weight of a cubic foot of air in pounds $= 0.075$.

In experiments with flying-machines (R. C. Buel, in Appleton's Cyclopaedia of mechanics, vol. i. p. 53), it has been ascertained that an angle of 54° 10″ is the most advantageous angle at which the vanes can be placed (these vanes are similar to the wing-fins of a flying-fish). Therefore $A' = A \times \sin 54° 10'' = \frac{1}{10}$ of a square foot, nearly.

The force with which the air will be pressed downward, or, what is equivalent, the lifting-power of these wings moving at V velocity, will be $\frac{V^2 A' W}{2g}$.

Substituting the numericals above recorded, we have $\frac{(12.78)^2 \times 0.1 \times 0.075}{64.3} = 0.0190507$ pounds, or about $\frac{0.019}{0.177} = \frac{1}{9}$ the weight of the fish in question.

The method of catching flying-fish on board the Albatross affords a means of observing some of their motions. When our submarine (Edison's) lamp is lowered a few inches below the surface of the water, these fish often approach it gradually. On such occasions they invariably have their pectorals and ventrals extended, but do not appear to use them as organs of locomotion: on becoming alarmed, they close these fins, and dart forward suddenly. The brilliancy of the electric light, no doubt, dazzles their eyes greatly, for they do not appear to see objects near them, and, when alarmed by the splash of the scoop-net, dart right forward by use of the caudal fin. Mr. Nye, quickly perceiving this habit, takes advantage of it by plunging the net directly in front of the fish, which he almost invariably catches. On one occasion a fish turned in its flight, and projected itself several feet vertically into the air, very close to the side of the ship, working its wings vigorously, which was distinctly seen by several people on deck.

G. W. BAIRD.
Passed Assistant Engineer, U.S.N.
Washington, June 24.

An Indian snake-dance.

I have received a clipping from the New York *Commercial advertiser* containing a letter from a Mr. Trumble in reference to the article on the 'snake-dance' of the Moki Indians of Arizona (*Science*, vii. June 4). Mr. Trumble mentions the occurrence of similar performances among several Central and South American tribes, and discusses at some length the antidotes used. This feature was only touched upon in my paper for the reason that Dr. H. C. Yarrow of the army, who attended the dance at Wolpi for the special purpose of identifying the species of snakes used, and of determining whether they had been rendered innocuous, was present at the reading of the paper, and was kind enough to discuss it at some length. Perhaps the interest in the question would justify a few remarks on that phase of the subject. Dr. Yarrow identified four species of snakes, only one of which, however, was poisonous, — the spotted rattlesnake, or Crotalus confluentus. He descended into the snake *kiva* on the eve of the dance, and there examined the snakes which were to be used on the morrow. At his request a large rattlesnake, selected by himself, was held up for his examination by one of the Indians, and, upon prying its mouth open, he found the fangs intact and of large size. I may add, that, at the conclusion of the 1883 snake-dance, two rattlesnakes were captured, and sent to the national museum. They were examined soon after their arrival by Dr. S. Weir Mitchell of Philadelphia, who found them in perfect order: their fangs had not been disturbed, and the poison-sacks were intact and full of venom.

The snakes used in the dance undergo a very complicated course of treatment in the *kiva* where they are confined prior to their appearance in public. They are washed repeatedly in various kinds of 'medicine-water,' and are frequently handled or stroked with a downward, squeezing movement of the hand. Whether such treatment prolonged over a period of five or six days is sufficient to render innocuous a robust rattlesnake, is an open question. Both Captain Bourke in his book, and Dr. Yarrow in his remarks, mention seeing a large rattlesnake brought in from the fields on the day of the dance. These, at least, must have been capable of inflicting fatal wounds.

The Indians have the greatest confidence in the means they use to secure immunity. Dr. Yarrow, in an interview he had with the high priest soon after the dance, showed the old man a hypodermic syringe and a solution of permanganate of potassium, which he had brought along to use in case of necessity, and explained to him their use. The old man replied, "No doubt my brother's medicine is good, but we are quite satisfied with our own." The performers are very seldom bitten: I observed but one instance at Wolpi, none at Mashongnavi. Others, however, record two other instances at Wolpi, which escaped my attention: in both of these cases the bite was inflicted by non-venomous serpents. As the number of snakes used at that dance was about eighty, this is not a very high percentage. I am of the opinion that the Mokis rely on the previous treatment of the snakes, on their charms and incantations, rather than on any after-treatment of themselves. As Dr. Yarrow remarked, a snake which had been repeatedly handled, and had discovered that no injury was intended, would become comparatively tame, and this would account for the behavior of the snakes during the dance. In the hands of the dancers, they seem numbed and lifeless, and it was only when dropped rudely on the ground from the mouths of the dancers that they showed any disposition to fight.

The knowledge of the composition of the liquids used by the Mokis is confined to one man, a high priest; even the members of the order are ignorant of it: but, to provide against the loss of the secret, the knowledge is shared with an old woman of the tribe. The high priest keeps this knowledge to himself until he is, or thinks he is, on his death-bed;